REMARKS

Claims 1-6, all the claims pending, stand rejected. Claims 1, 5 and 6 are amended.

As a preliminary matter, Applicant notes that the Examiner has found Applicant's arguments filed on February 16, 2006 to be persuasive. Thus, the rejection under Randel and Drebin has been withdrawn. However, the Examiner has cited a new reference to Nagoshi et al. (6,234,901) against all of the claims, as discussed subsequently.

Claim Rejections - 35 U.S.C. § 102

Claims 1-6 are rejected under 35 U.S.C. § 102(b) as being anticipated by Nagoshi et al. (6,234,901). This rejection is traversed for at least the following reasons.

Initially, Applicant notes that the USPTO has published guidelines for the interpretation of "means plus function" limitations in claims. As set forth in MPEP 2181, anticipation of a claimed limitation requires a multi-step analysis. First, the corresponding structure in the specification of the application to be identified for each means. Second, a determination made as to whether the prior art teaches the identical function. Third the prior art is reviewed for a structure that is identical to or equivalent of that in the specification of the application, as identified, and performs that identical function. Thus, Applicant's analysis will follow these guidelines.

With respect to the subject matter of the invention generally, as explained in the previous amendment, the present invention is intended to facilitate the display of highlight features on an <u>opaque</u> object, where a processor has limited capability, such as a household game machine with microprocessor 14, as explained at pages 6 and 7 of the present application. In order to accomplish this result, the image of a highlight <u>opaque</u> object is (1) generated, (2) appropriately positioned, and (3) overlaid in parallel onto a main display object, as illustrated in Fig. 2.

The structure and steps for accomplishing this result are set forth in independent apparatus claim 1, independent method claim 5 and independent program product claim 6. The limitations in these claims are similar. However, the structure of independent claim 1, which defines the invention in terms of "means -plus- function" limitations, will be analyzed on the basis of existing USPTO Guidelines for such limitations.

Claim 1

Claim 1 is directed to an image processing device for displaying an image representing an object arranged in a virtual 3-dimensional space. The device is implemented as a system, as illustrated in Fig. 1, comprising a microprocessor 14, image processing unit 16 and display 18, which communicate via bus 12 with a main memory 26 and an I/O processing unit 30 that is connected to a variety of other I/O units. This structure is disclosed at pages 6 and 7. The operation of the image processing device is based upon software components in the main memory 26 and auxiliary storage 24 that are accessed by the microprocessor 14 and image processing unit 16. An explanation of the functions of the image processing device 10 is described at pages 10 and 11 with regard to the illustration in Fig. 8. The following are the recited means and their corresponding structures in claim 1:

<u>Light Source Position Acquisition Means</u> - the first element of claim 1 is the light source position acquisition means, which has the function of acquiring a light source position set in the virtual 3-dimensional space. As illustrated in Fig. 8, this unit 62 is coupled to two other calculation units. With reference to Fig. 2, the application explains at page 10 that the unit 62 acquires the light source position (LP) set in the virtual 3-dimensional space 50, where the position LP is pre-stored or calculated when the light source is dynamic.

<u>Viewpoint Position and Viewing Direction Acquisition Means</u> - the viewpoint position and viewing direction acquisition means has the function of acquiring a viewpoint position and viewing direction set in the virtual 3-dimensional space corresponds to unit 64 in Fig. 8. Unit 64 acquires the viewpoint position VP and the viewing direction VD set in the virtual 3-dimensional space 50, as illustrated in Fig. 2. The values of VP and VD may be stored or calculated when they are dynamic.

<u>Highlight Position Calculation Means</u> - the highlight position calculation means has the function of calculating a position of an image representing a highlight appearing on the surface of the object based upon the viewpoint position VP. As illustrated in Fig. 8, unit 66 corresponds to this means and receives an input from units 62 and 64. As explained at page 8, with respect to Fig. 5, the highlight position HP appearing on the surface of the soccer pitch object 54 may be

based on the viewpoint position VP. Unit 66 may set the highlight position HP based on the viewpoint position VP and the viewing direction VD at a predetermined position ahead of the visual line. For example, it may be set at a position where the incident angle is equal to the reflection angle, as illustrated in Fig. 6. Notably, the highlight position (or point of reflection) HP is the position of the highlight calculated by the highlight position calculation means, and is different from the position of the light source acquired by light source position acquisition means.

Highlight Intensity Calculation Means - the highlight intensity calculation means has the function of calculating intensity of the highlight based on the light source position and viewing direction. As represented by unit 68 in Fig. 8, this unit receives inputs from units 62 and 64 and outputs a signal to unit 70, a semitransparent composition unit. As explained at page 11, unit 68 calculates the highlight intensity based on the light source position LP and the viewing direction VD, as illustrated in Fig. 2. The "highlight intensity" is defined as the semitransparent composition rate used for semitransparent composition of the texture image representing a highlight onto the texture image representing the soccer pitch, with reference to Fig. 2.

Semitransparent Composition Means - the semitransparent composition means has the function of performing semitransparent composition of the image representing the highlight onto the image representing the object based on the position calculated by the highlight position calculation means and a semitransparent composition rate corresponding to the intensity calculated by the highlight intensity calculation means. As explained at page 11 with regard to the unit 70 illustrated in Fig. 8, this means performs semitransparent composition of the image representing a highlight (Fig. 4) onto the image representing the soccer pitch 54 (Fig. 3) based on the highlight position HP calculated by unit 66 and the composition rate corresponding to intensity, calculated by unit 68. As explained at page 8, the highlight object 52 is arranged at a highlight position HP set on the surface of the soccer pitch object 54 in parallel thereto. The texture image shown in Fig. 4 is mapped thereon and expresses the highlight appearing on the surface of the soccer pitch with a circular image at the center and a peripheral region assigned transparent attributes. The circular image may have a color different from the texture image for

expressing a highlight. The circular image may include a transparent or a semitransparent portion.

Nagoshi et al.

The Examiner notes that Nagoshi et al. discloses a video block 11 in Fig. 1 having a video display processor 120, which performs drawing of objects comprised of polygon data in a video game. It also illustrates a video display processor 130, which performs the drawing of background pictures, synthesis of polygon picture data with the background pictures and clipping processing, with reference to col. 6, lines 1-7. Nagoshi et al. controls the overall operation of the device with a main CPU 101 for executing application software at high speed (col. 5, lines 34-37). The Examiner asserts that this basic structure in Nagoshi et al., which is asserted to correspond to the architecture of the present invention in Fig. 1, operates to provide the several means limitations in claim 1.

Before addressing each limitation, Applicants respectfully note that in Nagoshi et al, a flare appears on a surface of a plane of projection 22 which corresponds to a 2-dimensional screen of a television monitor (col. 7, line 31). The plane of projection 22 is transparent (Fig. 3). On the other hand, the highlight in the present application appears on a surface of opaque object arranged in a virtual three-dimensional space. Also, a semitransparent composition means in the present application is used to perform semitransparent composition of an image representing the highlight onto an image representing the opaque object.

Claim 1 has been amended to further clarify this feature.

Light Source Position Acquisition Means

As to this first limitation, the Examiner asserts that in Nagoshi et al there is a light source position acquisition means that determines a position relationship with a light source located within a camera view, as disclosed at col. 7, lines 55-56. With respect to the definition of a viewpoint position, the Examiner refers to Fig. 3 where the letter "A" indicates a unit vector on a line linking a camera position and a light source (col. 7, lines 37-38) and acquires a camera or a viewpoint position 21. The Examiner also notes that the CPU 101 provides a viewpoint direction acquisition means for determining to what extent the camera is facing the direction of the light

source, with reference to col. 7, lines 54-55. The Examiner notes that a line linking the camera position with the light source object is converted into a line E on a 2-dimensional screen and the route of a light ray in a screen picture is specified with regard to step S116 in Fig. 2.

Nagoshi et al. does not teach a structure identical to or equivalent of the corresponding structure in the present application for the recited means. One difference is that the present application considers reflected light, as illustrated in Fig. 6. Notably, the highlight position (or point of reflection) HP is the position of the highlight calculated by the highlight position calculation means, and is different from the position of the light source acquired by light source position acquisition means.

Highlight Position and Intensity Calculation Means

With regard to the highlight position calculation means, the reference teaches the performance of "flare processing," which indicates a manner in which the picture is influenced by a light source at a particular location, as discussed at col. 8, line 9-45. Flare processing is performed on the basis of a threshold value C that is based on the extent to which a camera at a known position is facing in the direction of the light source in another position. This calculation is taught at col. 7, line 43 - col. 8, line 8.

The calculation is based on a product of a unit vector A, which represents a segment linking the camera position with the light source in a 3-dimensional virtual space, and a unit vector B, which represents the facing direction of the camera. Nagoshi et al. notes that as the vectors are separated apart, the product C becomes close to zero, such that there is less effect of the intensity of the light source on the inner product C. Nagoshi et al also illustrates in Figs. 7A and 7B a relationship between intensity of light source and flare degree C, as well as the angle between elements A and B. Thus, the Examiner finds in these teachings both a highlight position calculation means which calculates an image representing a highlight (or flare) and a highlight intensity calculation means, which calculates an intensity of the flare based upon light source position and viewing direction.

However, Applicant respectfully notes that in Nagoshi et al., a line linking the camera position with the light source object is converted into a line E on a two-dimensional screen and

<u>the line E is a route of the ray in a screen picture (col. 8, line 34 and Fig. 2 S116)</u>. Further, flare polygons are drawn at appropriate positions along the line E (col. 8, line 37 and Fig. 2, S118). Accordingly, the position of the flare calculated in Nagoshi et al is the position on the screen. On the other hand, the highlight position calculation means in the present application calculates the position of the image representing highlight caused by the reflection of the light from the light source appearing on the surface of the object, and the position is in virtual three-dimensional space.

The claims, as amended, clearly define these distinctive features and clarify this important difference.

<u>Semitransparent Composition Means</u>

With regard to the semitransparent composition means, the Examiner notes that a transparency D in proportion to the value C is found in the processing disclosing in Nagoshi et al., particularly step S114 at Fig. 2, as disclosed at col. 8, lines 32-33. The Examiner observes that if the transparency D is semitransparent, half of the luminance of a ground picture is added to half of the luminance of the flare polygon, and the results of addition are drawn on the frame buffer, thereby obtaining a flare picture, as identified in step S118 and illustrated in Fig. 2 and disclosed at col. 8, lines 38-42.

The claim limitation requires the calculation of a semitransparent composition <u>rate</u>, corresponding to intensity. The Examiner asserts that such <u>rate</u> corresponds to the transparency D proportional to the inner product C, as calculated from vectors A and B in which vector A corresponds to an incident light having a direction and size (or strength of light), as disclosed at col. 8, lines 7-8. The Examiner asserts that this corresponds to the intensity calculated by the highlight intensity calculation means.

As already noted, the semitransparent composition means in the present application is used to perform semitransparent composition of an image representing the <u>highlight</u> onto an image representing the <u>opaque object</u>. The parent claim 1 is amended to specify this feature. It is not found in Nagoshi et al.

Claims 2 and 3

With regard to claims 2 and 3, the Examiner observes that the Nagoshi et al. reference teaches a line linking a camera position with a light source object, which is converted into a line E on a 2-dimensional screen in a route of array in a screen picture is specified at step S116 in Fig. 2. The Examiner further observes that flare polygons having a transparency D are drawn at appropriate positions along the line E, as disclosed at col. 8, lines 34-38, based on a viewpoint position, viewpoint direction and a light source position because line E is formed by the camera position and direction with respect to the light source position.

First, Applicant notes that there is no illustration of lines E and points D in any of the figures of Nagoshi et al. Thus, the precise arrangement contemplated in the prior art is not clear.

Second, the dependent claims 2 and 3 identify the calculation of the highlight position calculation means as being based upon viewpoint position and one of viewing direction and light source position, respectively. The Examiner has indicated that the line E is formed by the camera position and direction with respect to the light source position and, thus, the calculation is based on the viewpoint position, viewpoint direction and light source position.

As already noted, in Nagoshi et al., a line linking the camera position with the light source object is converted into a line E <u>on a two-dimensional screen</u> and the line E is a route of the ray <u>in a screen picture</u>. _Further, flare polygons are drawn at appropriate positions along the line E. Accordingly, the position of the flare calculated in Nagoshi et al is <u>the position on the 2-dimensional screen</u>. By contrast, the position of the image representing highlight caused by the reflection of the light from the light source appearing on the surface of the object <u>is in virtual three-dimensional space</u>. As already noted, parent claim 1 has been amended to specify this feature.

Claim 4

Finally, with regard to claim 4, which requires a direction connecting two of the light source position, viewpoint position and highlight position as a basis for calculating highlight intensity, the Examiner points to the unit vectors A and B in Fig. 3 which form an angle, as disclosed at col. 7, lines 40-41 now used to calculate the product C. The Examiner asserts that as

the value C of the inner product is larger, the rays come straight from a light source and enters the camera lens. This indicates that stronger flares (highlights) are to be generated, as explained at col. 8, lines 24-28. The Examiner asserts that this is based on the viewing direction and the direction connecting two of the light source position, viewpoint position and highlight position because unit vectors A and B used in the calculation are dependent upon the viewing direction, light source position and viewpoint position as shown in Fig. 3.

This claim is patentable for at least the reasons given for claim 1, as amended.

Claims 5 and 6

With regard to the remaining claims, the Examiner notes that the analysis would be the same for the method and program product claims. In reply, Applicant notes that the amendments to claim 1 also have been made to claims 5 and 6, and that the claims would be patentable for the same reasons.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

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23373
CUSTOMER NUMBER

Date: August 17, 2006